CLAIMS

We claim:

1. In vapor compression equipment having a compressor, a condenser, an expansion device and an evaporator arranged in succession and connected via a conduit in a closed loop for circulating refrigerant through the closed loop, a process for determining the airflow rate through the evaporator, the process comprising the steps of:

obtaining the suction dew point and discharge dew point temperatures from the suction line and liquid line pressures;

obtaining the refrigerant mass flow rate that corresponds to the compressor in the vapor compression cycle for the dew point temperatures and suction line superheat;

obtaining the enthalpies at the suction line and at the inlet of the evaporator;

obtaining the enthalpies of the air entering and leaving the evaporator; and

calculating the airflow mass flow rate across the evaporator.

2. The process of claim 1 wherein said step of obtaining the mass flow rate comprises the step of calculating compressor performance data from ARI (Air-Conditioning and Refrigeration Institute) Standard 540-1999 performance equations available for the specific compressor.

3. The process of claim 2, further comprising the steps of:

calculating the suction line superheat;

obtaining the suction line superheat specified by the compressor manufacturer;

comparing the calculated suction line superheat to the suction line superheat specified by the compressor manufacturer; and,

if the calculated suction line superheat is different than the suction line superheat specified by the compressor manufacturer, correcting the mass flow rate by multiplying the suction line superheat specified by the compressor manufacturer by the ratio of the design suction line absolute temperature over the actual suction line absolute temperature.

4. The process of claim 1 wherein said step of obtaining the mass flow rate comprises the step of determining the compressor map equation by reading relevant information from the compressor manufacturer's look-up table for the specific compressor.

5. The process of claim 4, further comprising the steps of:

calculating the suction line superheat;

obtaining the suction line superheat specified by the compressor manufacturer;

comparing the calculated suction line superheat to the suction line superheat specified by the compressor manufacturer; and,

if the calculated suction line superheat is different than the suction line superheat specified by the compressor manufacturer, correcting the mass flow rate by multiplying the suction line superheat specified by the compressor manufacturer by the ratio of the design suction line absolute temperature over the actual suction line absolute temperature.

6. The process of claim 1, where the mass flow rate is determined from information obtained from a compressor similar to but not exactly the same as said compressor being in the vapor compression cycle.

7. The process of claim 6 wherein said step of obtaining the mass flow rate comprises the step of determining the compressor map equation by reading relevant information from the compressor manufacturer's look-up table for a compressor similar to the specific compressor used in the vapor compression cycle.

8. The process of claim 7, further comprising the steps of:

calculating the suction line superheat;

obtaining the suction line superheat specified by the compressor manufacturer;

comparing the calculated suction line superheat to the suction line superheat specified by the compressor manufacturer; and,

if the calculated suction line superheat is different than the suction line superheat specified by the compressor manufacturer, correcting the mass flow rate by multiplying the suction line superheat specified by the compressor manufacturer by the ratio of the design suction line absolute temperature over the actual suction line absolute temperature.

9. The process of claim 1, where the refrigerant leaves the condenser as a liquid-vapor mixture, and its enthalpy is calculated through the following steps:

measuring the temperature of the air entering the condenser;

obtaining the enthalpy of the saturated vapor at the liquid pressure;

obtaining the latent heat of vaporization at the liquid pressure;

calculating the difference between the condensing temperature and the temperature of the air entering the condenser;

obtaining the nominal difference between the condensing temperature and the temperature of the air entering the condenser; and

calculating the enthalpy of the refrigerant as the enthalpy of the saturated vapor at the liquid pressure minus the ratio of the difference between the condensing temperature and the temperature of the air entering the condenser to the nominal difference between the condensing temperature and the temperature of the air entering the condenser, and multiplying the ratio by the latent heat of vaporization at the liquid pressure.

10. In vapor compression equipment having a compressor, a condenser, an expansion device and an evaporator arranged in succession and connected via a conduit in a closed loop for circulating refrigerant through the closed loop, a process for determining the airflow through the evaporator, the process comprising the steps of:

measuring liquid line pressure, suction line pressure, suction line temperature, and liquid line temperature;

obtaining the suction dew point and discharge dew point temperatures from the suction line and liquid line pressures;

obtaining the suction line superheat;

obtaining the mass flow rate that corresponds to the compressor in the vapor

compression cycle for the dew point temperatures and suction line superheat;

obtaining the suction line superheat specified by the compressor manufacturer;

comparing the calculated suction line superheat to the suction line superheat specified by the compressor manufacturer; and,

if the calculated suction line superheat is different than the suction line superheat specified by the compressor manufacturer, correcting the mass flow rate by multiplying the suction line superheat specified by the compressor manufacturer by the ratio of the design suction line absolute temperature over the actual suction line absolute temperature;

obtaining the enthalpies at the suction line and at the inlet of the evaporator;

calculating the capacity of the vapor compression cycle from the mass flow rate and the enthalpies across the evaporator;

obtaining the enthalpies of the air entering and leaving the evaporator; and

calculating the airflow mass flow rate across the evaporator.

11. The process of claim 10 wherein said step of obtaining the mass flow rate comprises the step of calculating compressor performance data from ARI (Air-Conditioning and Refrigeration Institute) Standard 540-1999 performance equations available for the specific compressor.

12. The process of claim 10 wherein said step of obtaining the mass flow rate comprises the step of determining the compressor map equation by reading relevant information from the compressor manufacturer's look-up table for the specific compressor.

13. The process of claim 10 wherein said step of obtaining the mass flow rate comprises the step of determining the compressor map equation by reading relevant information from the compressor manufacturer's look-up table for a compressor similar to the specific compressor used in the vapor compression cycle.

14. The process of claim 10, where the refrigerant leaves the condenser as a liquid-vapor mixture, and its enthalpy is calculated through the following steps:

measuring the temperature of the air entering the condenser;

obtaining the enthalpy of the saturated vapor at the liquid pressure;

obtaining the latent heat of vaporization at the liquid pressure;

calculating the difference between the condensing temperature and the temperature of the air entering the condenser;

obtaining the nominal difference between the condensing temperature and the temperature of the air entering the condenser;

calculating the enthalpy of the refrigerant as the enthalpy of the saturated vapor at the liquid pressure minus the ratio of the difference between the condensing temperature and the temperature of the air entering the condenser to the nominal difference between the condensing temperature and the temperature of the air entering the condenser, then multiplying the ratio by the latent heat of vaporization at the liquid pressure.